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The use of productive questions in the early childhood classroom

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THE USE OF PRODUCTIVE QUESTIONS

IN THE EARLY CHILDHOOD CLASSROOM

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INTRODUCTION

Productive questions have become one of many effective teaching strategies in the early childhood classroom. Productive questions are questions that teachers or students can ask that produce an answer, with the answer not only verbal but often being shown by the student physically (Martens, 1999). Productive questions are not yes or no questions or low-level, factual recall questions. Productive questions aid in the construction of student knowledge, help students make connections between prior and new experiences, and aid in the development of student curiosity.

Children in early childhood are also developmentally different from students who are in elementary school (Britz & Richard, 1992). Pre-kindergarten students cannot be expected to remain seated for a long period of time. It is not developmentally appropriate to provide worksheets for early childhood students and they will also not learn by listening to a lecture. Students who are 3-5 years old are active explorers of their surroundings. The teacher in early childhood classrooms could be seen as a facilitator of student knowledge as a teacher.

There are right and wrong ways to ask productive questions. A wrongly asked productive question could result in a confused child, an ignored or incorrect response, and a missed opportunity for learning. A well-timed and well-asked question could spur curiosity, promote student leadership, and increase learning. Teachers who interact and build relationships with their students will be more able to ask an effective productive question, because they know their students and how they think. When productive questions are de-mystified and made clear and understandable, early childhood educators will be better equipped to ask them appropriately.

The purpose of this study is to discover how productive questions can be used in the early childhood classroom. To establish a foundation, child development, early childhood education, and questioning strategies that are currently employed in school or day care settings will be covered first. Finally, there will be a look at the misunderstandings that current pre-service educators have with the different types of productive questions and how to use them in a developmentally appropriate manner with students in the early childhood years.

This study reported here was a pilot study for a more extensive research project to come. The information gathered for this project will serve as an initial exercise for identifying the problems that pre-service teachers have with asking productive questions. In the future, more research will be needed to discover the effects of the results of this study in early childhood classrooms. Again, this study is only the beginning of a quest for more information on practical productive question usage.

Early Childhood Development

One of the leading researchers of early childhood development was Jean Piaget. Piaget had much to say on the development of children's thought processes, their behaviors, and effective ways to approach learning in light of these beliefs. He developed the four stages of cognitive development. Table 1 presents these four stages, based on information found in *Infants, Toddlers, and Caregivers* by Janet Gonzalez-Mena and Dianne Eyer (2007).

Table 1

Piaget's Cognitive Development Stages

Stage	General Description
Sensorimotor Stage (0-2 years)	Child progresses from reflexive action to symbolic activities; has ability to separate self from objects; has limited awareness of cause and effect.
Preoperational Stage (2-7 years)	Child is able to use symbols, such as words; has better reasoning skills but is still perceptually bound in the here and now.
Concrete Operational Stage (7-11 years)	Child has logical thought, but only in regard to concrete objects; has ability to order things by number, size, or class; also has ability to relate time and space.
Formal Operational Stage (11 years and older)	Child has abstract, logical thought; has ability to consider alternatives in problem solving.

Jean Piaget was also one of the first to theorize about constructivism. Constructivism is the idea that students construct their own knowledge through their experiences. Young children are just at the beginning stages of knowledge development, and so they have a lot of constructing to go through. Similarly, Piaget wrote on the topic of intelligence and egocentrism found in children. This concept of egocentrism explains the different ways in which children think and why they hold their seemingly illogical beliefs. Piaget (1977) defined intelligence in this way:

> Logical activity is not the whole of intelligence. One can be intelligent without being particularly logical. The main functions of intelligence, that of inventing solutions, and that of verifying them, do not necessarily involve one another; the first partakes of imagination, the second alone is properly logical. Demonstration, search for truth, is therefore the true function of logic…But on what occasions do we experience the need to verify our thought? This need does not arise spontaneously in us. On the contrary, it appears very late, and for two reasons. This first is that thought puts itself at the service of the immediate satisfaction of desire long before forcing itself to seek for truth. [The] most spontaneous manifestation [of thought] is play, or at any rate that quasi-hallucinatory form of a imagination which allows us to regard desires as realized as soon as they are born. (p. 91)

Piaget went on to explain the importance of play for children in discovering their misunderstandings, and how socialization plays a role in knowledge construction. Piaget stated that children learn that things do not work when they are challenged by their peers. When they must prove how something works, they must think about verbalizing their proof to their peers. Without the necessity of proving their beliefs to somebody, they will continue on in their understandings of the world, even if they are wrong. Teachers work to correct these understandings, and do so in a similar format, so that children have to prove their understandings. This gives sufficient evidence for the need of productive questions in early childhood education. Children will continue to believe their own mistaken beliefs until they experience otherwise, or have to prove them to someone else, whether that be their teacher or peers (Piaget, 1977). Productive questions can be asked to provoke thought in children. When productive questions are used appropriately, they will expose the misunderstandings that children have; and as children work to prove or produce answers, they will construct new, more useful knowledge.

Questioning Techniques

An article written by Kenneth Vogler (2005), "Improving Your Verbal Questioning," showed the importance of questioning. In his first paragraph he pointed out the significance and the reasoning behind asking questions: "Asking questions can stimulate students to think about the content being studied, connect it to prior knowledge, consider its meanings and implications, and explore its applications" (p. 98). Discussing the necessity of asking good questions, he warned about how easy it is to confuse students with the tone of the questions or how teachers word questions. If productive questions are not asked in a way that students can understand, the questions will not be productive.

Yet another aspect of questioning includes the use of taxonomies. A taxonomy is a categorization of levels. For questioning techniques, Overbaugh and Schultz stated that the categories run from low-level, factual questions to higher-order, complex questions. A higher-order question will be different for a four-year-old than for a junior in high school. However, the thought processes are similar, in that asking a productive question to both students will get them to produce an answer. For example, asking "What will happen if…" will cause students to think about the reaction that will happen from the action described in the question. The older student has more background knowledge and is at a higher cognitive stage according to Piaget, so he/she would be able to more capable of determining a correct answer.

Joan Britz and Norma Richard (1992) also wrote about the importance of questions and connecting knowledge in *Problem Solving in the Early Childhood Classroom*. They pointed out how it is important for teachers to help students see the connection between the knowledge they already have and the current problem they are working on. The authors said that one very important factor to keep in mind when helping students connect knowledge is the teacher's understanding of the student's prior knowledge. Britz and Richard believed that to have this understanding, a teacher must view problems from the child's perspective. This requires much observation on the teacher's part. The authors stated that it is essential for the teacher to know what is going on in the child's head before he/she can ask an appropriate productive question.

Productive Questions Defined

The difference between an effective and ineffective question comes down to whether or not the answer was productive. The term "productive questions" was explored by Jos Elstgeest (1985). Elstgeest described the productive question:

> A good question is the first step towards an answer; is a problem to which there is a solution. A good question is a stimulating question which is an invitation to a closer look, a new experiment or a fresh exercise. The right question leads to where the answer can be found: to the real objects or events under study, there where the solution lies hidden. The right question asks children to show rather than to say the answer: they can go and make sure for themselves. I would like to call such questions "productive" questions, because they stimulate productive activity. (p. 37)

Such productive questions are used in many classrooms. An article by Mary Lee Martens (1999), "Productive Questions: Tools for Supporting Constructivist Learning," is an example of productive question usage in elementary classrooms. This article is geared towards elementary science teachers, but can be used by teachers of all levels and content areas. Martens listed the different types of productive questions and gave question stem examples of each of these in a sidebar in her article.

The categories of productive questions found in the article by Mary Lee Martens prove to be challenging for early childhood educators to understand or create questions from. The different types of productive questions listed in her article include attention focusing, measuring and counting, comparison, action, problem posing, and reasoning (Martens, 1999). Another challenge with the types of productive questions is that they are not mutually exclusive, that is, there is much overlap among categories.

Another thing for educators to keep in mind when developing questions for students in the pre-primary age is that students are at a much different cognitive level than the educator. While this may seem like an obvious fact, productive questions developed for 3-5 year olds are often much too complex to be understood by them. It is hard for educators, who are and have been for a while in Piaget's formal operations stage, to think back to the concrete stage at which their students are located. It is very difficult for one to try and think as another thinks, when the thought processes are so contrasting. It is also easy to think that productive questions are merely "teachable moments" and ignore the importance of planning ahead for them. Planning productive questions beforehand could be helpful, albeit difficult.

Other problems that educators may face with productive questions are in the same vein as the complexity issue. Teachers often ask stacked questions, where there are two or more questions combined into one. Another unhelpful questioning technique is when educators come up with two ways of asking the same question. Counter-factual questions are also virtually impossible for pre-primary students to answer. These questions state a fact and then ask if that is not the case. It is very challenging for young learners to keep more than one thing in their mind at a time. Asking students to think about an object in its present and future states at the same time is very confusing. This is the same reason why causal reasoning questions (the why questions) cannot be asked to most young students. They require too much information for students to keep in their mind at one time. Students in the pre-operational stage of Piaget's cognitive development theory are still developing abilities to be able to hold more than one thing in their mind at a time. These students are focused mainly on the present, and find past and future events hard to comprehend.

Because preschool students (see Table 1) have a hard time focusing on two things, productive questioning is a good strategy to bring clarity. The first category of productive questions that Martens (1999) talks about is attention focusing questions. Attention focusing questions are intended to focus a child's attention on something that he/she has been overlooking in his/her play. This requires teacher observation of the students. When a teacher notices that students are not paying attention to the problem, it is time to utilize an attention focusing question. Examples include, "What do you notice about…?" or "How did you do that?" In particular, attention focusing questions are hard to plan ahead for without a context, because they are often the teachable moments.

The second category of productive questions involves mathematical thought processes. Martens made a distinction between measuring/counting questions and comparison questions in her article for primary students. Standards for early childhood education in mathematics mainly involve comparing objects in some way, whether that is by quantities or qualities. Therefore, these two categories could be combined to be one type of questioning for early childhood students.

Another type of productive question Martens (1999) uses is called an action question. The definition of an action question is that the question leads directly to an action done by the student. The child does not usually answer with only a verbal reply; students at this level will actually do what the teacher is asking to figure out the answer.

The easiest type of productive questions for teachers to develop is usually problem posing questions. An example stem of a problem posing question would be "Can you find a way to…?" These questions are honest questions; even the teachers sometimes do not know what the answer will be.

One of the hardest types of productive questions to ask is the reasoning question. It is important to understand the difference between inductive and deductive reasoning and be able to see examples in how students are using these two types of reasoning in their explorations. If students are asked to make a rule up about something they will confuse the term “rule” with a behavior rule. An alternative way to ask for a generalization from inductive reasoning might be, “What have you learned about how…?” Reasoning questions tend to be almost impossible to answer without a relationship between the student and the knowledge the students are forming. Some example stems for deductive reasoning questions include “What would happen if…?” or “What happens when…?”

The reasoning questions are a bit difficult for teachers to create and ask for a couple of reasons. First, it is just more difficult to think of a reasoning question that would be appropriate for young children. Because they are at the pre-operational stage of thinking, early childhood students are yet to have an ability to grasp abstract ideas. These are less acceptable productive questions because, essentially, students are producing nothing concrete. Elstgeest (1985) cautions against the wrong motivations of reasoning questions, but also believes they do have an important place in the classroom:

> What we should eliminate however is the impression that to every question of this sort there is one right answer. Reasoning questions are not meant to be answered in a unique way. They are meant to make children think and reason independently about their own experiences. They are meant to make them reflect upon the relationships they have discovered or recognized, so they can carefully begin to draw conclusions, or make generalizations, on the strength of real evidence that they have collected or uncovered. (p. 41)

One key ingredient in the development of effective reasoning questions would be to keep this statement in mind: If the educator is not able to answer the question, how will a 3 year old? Other principles that are helpful in guiding productive question usage involve a focus on and understanding of the students. Productive questions and other comments that teachers use are meant to encourage children’s reasoning during their play.

Engaging Inquiry

One problem that affects learning today is student boredom. When students are bored, they will not learn. If students are not learning, schools are not doing their job. In “Springing into Active Learning,” author Allison Zmuda (2008) addressed the issue of boredom. “This boredom depresses their performance, which typically causes teachers to further sanitize …with more structures, scaffolds, and cues—which, unsurprisingly, creates more boredom” (p. 39). Inquiry, on the other hand, is not a boring process. Inquiry requires that students think and are involved in their own learning. When students are interested, classroom management issues will lessen, and boredom should also decrease.

Inquiry requires students to problem solve. Problem solving involves struggling. Zmuda states that some struggling is necessary for learning in the classroom. While some learning can come without a struggle, other learning requires perseverance. It is healthy for students to struggle in appropriate doses:

> Students need to learn to embrace struggle as a necessary part of growth. This lesson is crucial, not only for developing resiliency, but also for honing creativity, ingenuity, and entrepreneurship. One of the best ways to model high engagement during times of significant struggle—when students agonize to improve, to understand the problem, to break through existing barriers—is to share the insights of famous people from different time periods and fields who struggled with learning within their respective domains. (Zmuda, 2008, p. 41)

Even at a young age, it is important for students to be learning about other great learners and inventors of the past and present. Students in early childhood classrooms could be seen as scientists and researchers, through their natural curiosity. Scientists, business people, and professionals of all sorts struggle at some point of their career. It is often through these struggles that each of these individuals produces their best work. This is one reason for learning how to struggle, to keep on persevering, even when students do not want to.

Children should learn that struggle is an important part of the learning and creative process. Educators who allow children to struggle with their own problems can help students learn and grow.

Inquiry is often not a linear process. Problem solving is a very complex process, even for students in early childhood. Inquiry is a search for knowledge or information. Thus, inquiry is not a method that should merely be used as a teaching strategy for one class period. Inquiry is engaged in day after day, especially in early childhood education, where the students are most naturally curious and already are discoverers of their surroundings.

Inquiry is engaging. Pursuing interests is something that students from 0-5 years old are doing in their daily lives, whether that is at home, in a school, or in a day care setting. Steven Wolk (2004) wrote in *Phi Delta Kappan,* "Rethinking curricula as inquiry is one of the best ways that we can teach this essential knowledge and make content and skills infinitely more meaningful" (p. 116). Inquiry does not necessarily have to be confined to the science classroom either. Inquiry is a focus on one thing through many subjects. As Wolk mentioned, inquiry could be the curriculum used in our pre-kindergarten classrooms. Inquiry is essentially a child's whole mission in life, discovering answers in his/her play and exploration. Young children are excited about the world because it is such a new place for them. Normal events that older students take for granted can become fascinating phenomenon.

This every day type of inquiry is intrinsically motivating for students. Zmuda (2008) wrote about student boredom as a cycle: "The more schools require students to merely remember, the more bored students become" (p. 39). If educators fail to make school a place children want to be, they will lose the students. Wolk went even further, saying, "Teaching through inquiry considers our work a failure if students do not leave school filled with questions and the yearning to explore them" (p. 118). The process of developing lifelong learners involves developing students who have knowledge, and yet also have questions. Curious students with the ability to pursue their own direction will develop into adults who are also curious entrepreneurs.

Inquiry is the opposite of lecture. While there is room for circle time or story reading, students in early childhood education cannot be expected to learn through extended periods of sitting still and listening. However, on the opposite side of lecture is the view of discovery learning. While participating in inquiry-based learning, students are not merely playing and doing whatever they would like in early childhood classrooms. Inquiry requires collaboration, investigation, and the production of knowledge (Wolk, 2004), whereas a lecture format involves individual students sitting and listening to the facts and ideas transmitted through another person.

Inquiry is also developmentally appropriate for students because it is relevant to their lives. Inquiry learning is authentic. Children are working to discover answers to questions that they came up with, not questions that are found in a pre-made curriculum or book. These types of questions may sometimes not even have an answer to find; however, they do aid in develop critical thinking skills in children.

Not only is inquiry-based learning engaging, but it also promotes student ownership. When students are being questioned in their classrooms to find out things they are interested in, they develop their own questions, and thus begin to take ownership of their own learning. Student ownership occurs when students own the learning that they are participating in. Essentially, students become responsible for what they are going to learn. This is possible even at an early age. In a short article for *Educational Leadership*, Marge Scherer (2008) talked about the different strategies educators should try in order to promote student ownership in their classrooms:

> First, our authors suggest how to engage students—from providing relevant curriculum to using technology appropriately; from offering choice in learning projects to making sure some learning can be active; from letting kids move at their own pace to introducing students to authentic audiences who actually put students' work to use. (p. 7)

Using curricula that pertain to children's lives, letting students decide the direction of the unit, and making learning activities as authentic as possible are all important in early childhood education. Relevant curriculum is curriculum that ties into a student's daily life and the world around them. Finally, Britz and Richard (1992) wrote that children who are between the ages of zero and seven years old are active learners. They learn by doing, and the doing comes out in their play.

Closely related to the inquiry process is play-based curriculum. Another aspect of early childhood education is the importance and necessity of play. A source that strongly supports play-based curriculum is "Revisiting 'Play:' Analyzing and Articulating Acts of Inquiry" by Joan Youngquist and Jann Pataray-Ching (2004). The article presented the negative view that parents, administrators, and some teachers often give to play in the classroom. The authors discussed the need for definitions of the different kinds of play that occur both inside and outside the early childhood classroom. Play goes hand in hand with inquiry methods. Some of the most helpful definitions of inquiry for early childhood learners are found in this article:

> In this light, we view all definitions of play as forms of inquiry that occur both within and beyond educational settings. We agree with Sponseller (1982) that play must be intrinsically motivated and personally and socially meaningful to the learner. We

> also agree with Lillard (1998) that every act of play contributes to theories the learner is constructing…. (Youngquist & Pataray-Ching, 2004, p. 172)

Productive questions need to produce play, where children are interacting with peers and manipulatives to find answers to the teacher's and their own questions. Naturally, productive questions are also personally and socially meaningful as they occur in settings in which the students are already interested. As young students play with ramps and marbles, flashlights in the dark, or bubble wands and bubble solution, they will naturally come up with their own questions about what they are doing. By watching the other children who are playing with them, they will also want to imitate their peers if their peers do something that interests them. The questions that students come up with in this manner will guide their play.

Youngquist and Pataray-Ching also showed the importance of the use of productive questions by the students themselves either on their own, or with their classmates. Productive questions should be asked by students, showing their developing curiosity. Youngquist and Pataray-Ching discussed the paradigm shift that occurs when viewing students' play as inquiry.

> We learned that by referring to play in the early childhood curriculum as acts of inquiry, we were able to see children's potentials through more multifaceted ways-through their multiple ways of knowing and the multidisciplinary perspectives in which they approached their inquiries that would have been otherwise overlooked. Acts of inquiry, rather than acts of play, connote acts of involved learning that are educational, rigorous, and connected to schooling and a lifelong pursuit of knowing. (p. 172)

When students are able to produce their own questions to spur on learning, they have acquired a sense of ownership in their education. And when students are taught to do this at a young age, it becomes a great foundation for building lifelong pursuers of knowledge and understanding. Students who enjoy the learning process at a young age will be more inclined to enjoy the learning process at an older age. When we take children's play seriously, and analyze it on a deeper level, we can see all that they are accomplishing in seemingly trivial acts of play. Standards are being met and children are learning when teachers are facilitating higher level play with productive questions.

Meeting Early Childhood Standards

The last section spoke about the inquiry method. Wolk (2004) emphasized the necessity and place of inquiry in classrooms: "One long, well-planned, integrative inquiry unit will satisfy dozens of learning standards" (p. 122). These learning standards can be found in a myriad of places. One of those is Iowa's Early Learning Standards (Iowa Department of Education, 2006), the latest edition of early childhood standards for the state of Iowa. The new standards give thorough explanations of objectives, benchmarks, and behaviors with practical examples of each. The first standards to be discussed here deal with children's affinities towards learning.

The Iowa Early Learning Standards list the following for developing problem solving in students ages 0-5. These standards are found in the approaches to learning perspective. Problem solving is not seen in one specific curricular area, but is a skill that could be used in any of the content areas. Teachers provide opportunities for students to problem solve. Table 2 provides the Iowa Early Learning standards for problem solving for infants, toddlers, and preschoolers.

<u>Table 2</u>

Iowa Early Learning Standards in Problem Solving

Age	Standard	Benchmark
Infants and Toddlers	Infants and toddlers demonstrate strategies for reasoning and problem solving.	The infant or toddler: • Uses an object, action, or caregiver as a means to a goal, such as pulling a string to reach a toy or pushing a button to hear a sound. • Uses trial-and-error to find a solution to a problem. • Imitates a caregiver action to solve a problem.
Preschool	Children demonstrate strategies for reasoning and problem solving.	The child: • Shows interest in and finds a variety of solutions to questions, tasks, or problems. • Recognizes and solves problems through active exploration, including trial and error, and through interactions and discussions with peers and caregivers.

The last benchmarks in Table 2 give evidence of the need for productive questions in early childhood classrooms. Productive questions might help teachers to have students who show interest in and find a variety of solutions and recognize and solve problems through active exploration.

More specific to content areas, productive questions are able to cover areas of mathematics and science. Table 3 illustrates the Iowa Early Learning Standards that cover these two areas.

Table 3

Iowa Early Learning Standards for Mathematics

Age	Standard	Benchmark
Infants and Toddlers	Infants and toddlers show increasing understanding of comparisons and amount, including use of numbers and counting.	The infant: • Begins to notice characteristics of objects such as size, color, shape, or quantity. The toddler also: • Matches and sorts objects by size, shape, color, shape, or quantity.
Preschool	Children understand amount, including use of numbers and counting.	The child: • Shows recognition and naming of numerals (1,2,3). • Counts objects, matching numbers one-to-one with objects. • Uses language such as "more" or "less" to compare quantities.

Students come to understand numbers through various concrete, hands-on experiences working with numbers. Number knowledge progresses to linking amounts of things to their conventional numeral.

Finally, in Table 4, the Iowa Early Learning Standards name scientific reasoning an area to be covered. In this table one will find the beginnings of the scientific method.

Infants, toddlers, and preschoolers are all capable of observing their surroundings, describing the events that are happening, and predicting events that may happen.

Table 4

Iowa Early Learning Standards for Science

Age	Standard	Benchmark
Infants and Toddlers	Infants and toddlers observe, describe, and predict the world around them.	The infant or toddler: • Explores and manipulates natural materials such as water and sand. • Shows understanding of object permanence by looking for people and objects that have disappeared. • Notices their own individual needs. • Begins to notice and label objects and events in the environment.
Preschool	Children observe, describe, and predict the world around them.	The child: • Shows curiosity about living and non-living things. • Notices, describes, and predicts changes in the environment. • Shows respect for living things.

In the rationale given in the Iowa Early Learning Standards, inquiry-based learning is encouraged. The writers realized the importance of active learning for young students. The rationale also included the importance for students of learning the methods of scientists, rather than specific scientific knowledge, because in this information age, by the time these students are out into the real world, the scientific knowledge will have changed dramatically (Iowa Early Learning Standards, 2006).

Another place one can look for strong standards for science education specifically is the National Science Teachers Association. The National Science Teachers Association has developed a position statement for elementary students' learning. In the introduction to their standards, they put a high importance on early experiences. The website (www.nsta.org) describes the problem-solving skills that students are likely to develop when working with scientific ideas, and how this will help them in the future. Some of the position statements include the following:

- Elementary school students learn science best when they are involved in first-hand exploration and investigation and inquiry/process skills are nurtured.
- Elementary school students learn science best when instruction builds directly on the student's conceptual framework.
- Elementary school students learn science best when mathematics and communication skills are an integral part of science instruction.
- Elementary school students learn science best when inquiry skills and positive attitudes are modeled by the teacher and others involved in the education process. (National Science Teachers Association, www.nsta.org)

These four position statements echo the need for productive questions. Productive questions are almost synonymous to inquiry, and so in each of the above statements, one can see that they are helpful in developing student knowledge. The categories of productive questions also includes measuring/comparing, which is a way to connect it to math curriculum. Modeling the inquiring attitude teachers wish to see in their students may help students to exhibit that attitude. If teachers are interested and curious about what they are learning, students will most likely be as well.

METHODOLOGY

For a pilot study to investigate how well categories designed for primary grade teachers would work for prekindergarten-kindergarten pre-service teachers, I accessed anonymous data from a subset of 26 quizzes taken by Early Childhood major students in which they categorized productive questions that had been collected from classroom use by pre-service and in-service teachers. (See Appendix A for a copy of the quiz). I reduced the data by entering into an Excel spreadsheet the answers and errors for each productive question from the quiz. I tallied the number of errors students made on each type of question, and put each type of productive question in a column. Finally, I also typed out the questions that had mistakenly been thought to have been a different type of productive question. The next level of data reduction was finding patterns and identifying the most missed and least missed questions. I ranked the mistakes in order from most to least missed, and picked the most frequent errors in each category.

Following procedures according to Institutional Review Board guidelines, I recruited a group of 28 Early Childhood majors who were finishing their 10-week Level III field experiences in which they were practicing using productive questions. Having been given access to their assignments, my next step in the study will be to test the fit of the new set of categories to their field data reports. At this point in the ongoing study, I will just be reporting on the pilot study.

ANALYSIS AND DISCUSSION

In the research literature, the benefits of using productive questions were described by practitioners who use them. Much of the literature reviewed described the importance of questioning, establishing a rationale for its use in the early childhood classroom. However, questions that are asked of elementary students are not necessarily appropriate for students who are younger. The emphasis in early childhood education is on developmentally appropriate practice. Students in pre-kindergarten programs and below are more active learners. Asking questions of them in such a way that they may actively show their understanding may be helpful in their knowledge construction. Productive questions can be a solution to this problem, because many can be answered nonverbally in action, rather than just with a "yes" or "no."

This study has also included observing several class periods of Guidance. Guidance is a class for pre-service early childhood educators, where they begin to receive more instruction on productive questions. During the beginning of instruction on productive questions, the Guidance students were given a quiz on the different types of productive questions. The students had been assigned the Martens (1999) article on productive questions and had been required to construct their own productive questions specific to their learning center. After analyzing the errors from their quizzes, a number of hypotheses can be drawn.

By and large, reasoning questions were the most difficult type of question to identify. As mentioned previously, this was an expected result, because reasoning questions are difficult to construct so that they are appropriate for early childhood students. The two reasoning questions given on the quiz that were missed were the following: "What would happen if you used 10 straws instead of just one?" and "What will happen when the bubble hits the carpet?" These two questions were missed by virtually everyone in the class. If one looks closely at these two questions in particular, a couple of indicators show that they are reasoning questions. The use of “What would happen if…?” or “What will happen when…?” indicates that these two questions are asking for deductive reasoning that leads to a prediction. If this point is emphasized and repeated, pre-service teachers might be able to better understand and hopefully be able to construct their own reasoning questions with these two stems. The topic of reasoning questioning must be better researched and understood by pre-service teachers so that they will be able to ask these types of questions in a way that promotes student learning. Reasoning questions aid in promoting higher order thinking skills.

Another problematic question on the quiz was: “Ask Johnny how he got the marble to go in the cup.” Not only did many people miss this attention focusing question, but many also mistook it to be in the reasoning category of productive questions. Perhaps the Guidance students looked at the “how” that was in the question and connected it with reasoning.

The correctly categorized attention focusing questions on the test included: “What do you notice is happening when you make bubbles on the tray?” or “How did you do that?” or “What do you notice is happening when you use a cup instead of a tray?” These questions do look very similar to the reasoning questions, but there is one key word in two of the questions that set them apart, the word “notice.” Attention focusing questions are intended to get students to notice the problem or variables that they are not paying attention to.

Yet another point of confusion on the quiz was the question, “How can you tell how long the top was spinning before it was stopped?” This question is a type of measuring or counting question. The key words in this particular question would be “how long.”

Guidance students thought this could be anything from an attention focusing question to a problem posing question to a reasoning question. It does have elements of these different types of productive questions in it, but again, the "how long" marks it as asking for a measurement of time.

Finally, the last major point of confusion was what action questions could be. There was only one correct action question given on the quiz, and so this may have led to some misunderstandings, with students thinking there should be more than one check mark in the action column. Hardly anyone missed that action question, but there were so many other questions that students marked as action questions, leading to the aforementioned conclusion. A significant number of people thought that the two reasoning questions were actually action questions. Perhaps the one thing that this data suggests is that a restructuring of the types of productive questions might reduce some of the confusion in categorization. It may be helpful to clearly define productive questions and to provide good examples so that pre-service early childhood educators can have a good understanding of the different types of productive questions and how to use them in their own classrooms. These suggestions derived from the pilot study will be researched more by the author in the next part of the study.

CONCLUSIONS AND RECOMMENDATIONS

Productive questions are one strategy that could be used in early childhood settings. It would be helpful for early childhood educators to understand the thinking skills and developmental levels that each of their students is exhibiting. Also, it may be helpful if teachers take into consideration the child's point of view of the problem or play activity that the students are participating in. Asking productive questions to students in the pre-operational stage of cognitive development can be a difficult thing to do, but if all of the above are taken into consideration, question development will most likely be easier and more effective for student learning. It may be helpful if productive questions for students in early childhood were relevant and developmentally appropriate.

In order to help teachers better understand the different types of productive questions, I propose to reorder some categories. The categories that did not pose problems in the quiz responses can remain in their same form, because these are the categories that are easily understandable. For example, attention focusing questions should remain as they are. They include questions that ask the students to focus on something that they had previously been missing. Problem posing questions are also able to remain as they are, with the purpose being that they cause the child to think the problems they come up with in their play and to create a new solution.

The following transformations are recommended to result in four categories of productive questions for children in early childhood. Measuring/counting and comparison questions could be combined into one category for early childhood students. Developmentally appropriate standards for students at this age have students comparing more than counting. While students who are ready may be encouraged to count or measure, it will be more helpful for counting, measuring, and comparing to all be one category, fitting nicely into the mathematics area.

Finally, I think the action and reasoning questions should also be blended together as one group of questions. They are two very similar categories, and to avoid confusion, I think it would be very helpful to make the two categories one. Action questions also have a similar purpose to problem posing questions, in that they are to cause a student to do something, rather than say something, and so some action questions may also fall into the that category.

In essence then, for early childhood educators, there would be four types of productive questions:

1. Attention focusing questions
2. Mathematically thinking questions
3. Problem posing questions
4. Reasoning questions

One can see that the Iowa Early Learning Standards echo the idea of creating one group for mathematical questions, because students below kindergarten level are developmentally different, they may be counting or comparing. By grouping the productive question types in this manner, pre-service teachers will have a more manageable way to create productive questions.

These transformations are necessary in order to help pre-service educators ask effective productive questions. Transforming the categories will prevent any overlap between similar types of questions that are often confusing. A teacher should follow the child's lead in asking productive questions. It is important for teachers to follow the child's lead because one should not pursue a direction that the child is not interested in. Finally, it is also important to support children's tangible representations in play and the discussion of their ideas with their peers or the teacher.

The information that is laid out here provides a starting point for the next move in the research. Research could be continued into how to see the world from a child's perspective, and on the questions that students themselves come up with. Also more extensive productive question levels need to be developed. Martens (1999) gave productive questions stems for use in the elementary grades. Productive question stems could be created based on effectiveness and practical usage in early childhood classrooms. Were pre-service teachers given stems that were at a more appropriate level for their students, they might find it easier to construct questions more productive of inquiry in their younger students.

Productive questions are only one teaching strategy that could be utilized in classrooms of young students. It is not developmentally appropriate or educationally sound for teachers to only use one method of teaching. However, both content standards and research literature indicate that productive questions and inquiry-based learning are a good method to be used in classrooms to develop students who are critical thinkers, problem solvers, and curious. These higher level thinking skills found at the top of Bloom's Taxonomy, are the skills that productive questions are intended to promote (Overbaugh & Schultz). Children who are encouraged to reason, problem solve, and think outside of the box at a young age, will more than likely be able to continue in these skills into the elementary years and beyond. The ever-changing world today will leave behind those who do not have these skills.

The recommendations from this pilot study will become hypotheses at the starting point for continued research this summer. When the term is completed, student assignments will be available to collect more data on in order to continue to support or question the findings of this pilot study. Also, more research will be needed to see whether the questions that are designed this summer would be effective in early childhood classrooms.

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Appendix A

Productive Questions Quiz

#	Question	Attention	Meas/Ct	Compare	Action	ProbPose	Reason
01	Which of these 2 cups holds more?						
02	What would happen if you used 10 straws instead of just one?						
03	What happens when you blow very softly?						
04	How can you tell how long the top was spinning before it stopped?						
05	What do you notice is happening when you make bubbles on the tray?						
06	Which fabric makes the bubble snake the easiest?						
07	What can you do to the bubble without popping it?						
08	Which cup works better on the top?						
09	How many seconds did your top spin?						
10	I wonder how you can get the ball to go farther?						
11	What will happen when the bubble hits the carpet?						
12	Can you figure out a way to get the water from here to there?						
13	How did you do that?						
14	Which ones are alike?						
15	Can you think of another way to do it?						
16	Ask Johnny how he got the marble to go in the cup.						
17	How can you move the cups so all the water will flow into just one?						
18	Can any of them go in another place?						
19	What do you notice is happening when you use a cup instead of a tray?						
20	Can you find a way to make bubbles with a fork?						

Productive Questions Key

#	Question	Attention	Meas/Ct	Compare	Action	ProbPose	Reason
01	Which of these 2 cups holds more?		(x)				
02	What would happen if you used 10 straws instead of just one?						x
03	What happens when you blow very softly?				x		
04	How can you tell how long the top was spinning before it stopped?					(x)	
05	What do you notice is happening when you make bubbles on the tray?	x					
06	Which fabric makes the bubble snake the easiest?			x			
07	What can you do to the bubble without popping it?					x	
08	Which cup works better on the top?			x			
09	How many seconds did your top spin?		x				
10	I wonder how you can get the ball to go farther?					x	
11	What will happen when the bubble hits the carpet?						x
12	Can you figure out a way to get the water from here to there?					x	
13	How did you do that?	x					
14	Which ones are alike?			x			
15	Can you think of another way to do it?					x	
16	Ask Johnny how he got the marble to go in the cup.	x					
17	How can you move the cups so all the water will flow into just one?					x	
18	Can any of them go in another place?					x	
19	What do you notice is happening when you use a cup instead of a tray?	x					
20	Can you find a way to make bubbles with a fork?					x	